X-RAY EMISSION FROM THE QUASAR PKS 1127-145: COMPTONIZED IR PHOTONS ON PARSEC SCALES

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ABSTRACT

We model the broad-band spectral energy distribution of the innermost "core-jet" region of the redshift z=1.187 quasar PKS 1127-145. We propose a scenario where the high energy photons are produced via the Compton scattering of thermal IR radiation by the relativistic particles in a parsec-scale jet. The high energy spectrum, together with the observed radio variability and superluminal expansion, suggest that PKS 1127-145 may be a blazar, despite the fact that its optical/UV component is likely dominated by thermal radiation from an accretion disk. The relation of PKS 1127-145 to MeV - blazars is discussed.

Subject headings: gamma rays: theory — infrared: galaxies — quasars: individual (PKS 1127-145) — X-rays: general

1. Introduction

X-ray emission from the central regions of Active Galactic Nuclei (AGN) is associated with accretion flows or jets. The latter dominate the observed X-ray fluxes in blazars, the objects with powerful, relativistic jets oriented close to the line of sight. The X-ray spectra of these objects extend to high energy γ-rays and origin of both depends on the

total luminosity of a source (e.g. Fossati et al. 1998). In the least luminous sources, called High Energy Peaked BL Lacs, the X-rays are produced by synchrotron emission, while the γ-rays – presumably by Comptonization of the synchrotron radiation (SSC). In intermediate luminosity objects – Low Energy Peaked BL Lacs – both X-rays and γ-rays are likely produced by the SSC process. Finally, in the most luminous sources – Flat Spectrum Radio Quasars (FSRQ) – the high energy spectra are dominated by so-called external radiation Comptonization (ERC) process, but with a possible contribution to the soft/mid X-ray bands from the SSC radiation. Seed photons for the ERC process may come directly from the accretion disk (Dermer & Schlickeiser 1993), from the broad line region (BLR) (Sikora, Begelman & Rees 1994), and from an optically thick molecular torus in the form of thermal IR radiation from hot dust (Błażejowski et al. 2000). The luminosity of FSRQ detected with the Compton Gamma Ray Observatory (*CGRO*) is usually dominated by GeV radiation. However, there is a subclass of FSRQ with their luminosity peaked in the MeV band. Hereafter we call the former 'GeV-blazars', and the latter 'MeV-blazars'. A possible explanation for this division could be related to the location of the radiation site in the jet. As discussed by Sikora et al. (2002), in GeV-blazars radiation is produced closer to the central black hole, while in MeV-blazars, the active region is significantly farther from the center (see Sect. 3 for details). Currently, there are about a dozen known MeV-blazars or candidates for such a class; unfortunately any searches for them are limited by the low sensitivity of γ-ray detectors in the $1-30$ MeV band, where their spectra often have a peak.

PKS 1127-145 is a radio loud quasar at redshift z =1.187 with a radio spectrum peaked around 1 GHz, characteristic of the GigaHertz-Peaked (GPS) radio-sources (Stanghellini et al. 1998; O'Dea 1998). *Chandra* observations have revealed a large scale (at least $\sim$300 kpc) X-ray jet associated with weak radio emission (Siemiginowska et al. 2002). The extended radio structure is much weaker (nearly 3 orders of magnitude) than the core emission. This value is significantly lower in comparison to the typical FRI and FRII sources (Kellerman & Owen 1988). VLBI observations show a double component with a parsec scale jet on one side (Wehrle et al. 1992; Stanghellini et al. 1998). The core emission dominates also in X-rays and the total kpc-scale X-ray jet emission is $\sim$ 60 times fainter than the core emission (Siemiginowska et al. 2002). The strong X-ray core has also been detected by BeppoSax (Giommi et al. 2002), with the spectrum extending up to $\sim$ 300 keV. Finally, a very likely counterpart to that core is an EGRET source 2 EG J1134-1515 (Thompson et al. 1995).

We propose that the high energy emission originating in the central parsec-scale region of the quasar PKS 1127-145 can be described in terms of the blazar phenomenon. This can be justified by the following:

- as is the case for many γ-ray detected blazars, but contrary to steep spectrum radio quasars (SSRQ), the X-ray and γ-ray luminosities of PKS 1127-145 exceed the optical/UV luminosity by a very large factor (for X-rays in SSRQ see, e.g., Sanders, et al. 1989; Laor et al. 1997);

- the X-ray spectrum of PKS 1127-145 is much harder than in SSRQ ($\alpha_x \simeq 0.3 - 0.5$ vs. $0.6 - 0.8$) (e.g., Reeves & Turner 2000);

- in contrast to SSRQ, the luminosity is peaked in the γ-ray band (Thompson et al. 1995);

- the radio spectrum is flat and variable (Wehrle et al. 1992), and superluminal motion is observed (Jorstad et al. 2001).

At the same time, unlike a typical blazar, PKS 1127-145 has a very low optical polarization (Impey and Tapia 1990) and optical variability (Bozyan et al. 1990). This suggests a thermal origin of the optical/UV radiation. Such co-existence of the strong, non-thermal γ-ray component with a prominent thermal UV bump is a characteristic of the MeV-blazars. We show that the jet emission model developed by Sikora et al. (2002) for MeV-blazars can explain these spectral properties and make prediction that PKS 1127-145 can be variable in X-rays and γ-rays on the time scale of the order of a month.

2. The observations

We obtained the multiwavelength spectrum of PKS 1127-145 shown in Figure 1. from the literature. The radio data (Steppe et al. (1995), Geldzahler & Witzel (1981), Kuhr et al. (1981), Shimmins & Wall (1973), Wright & Otrupcek (1990), Griffith et al. (1994), Condon et al. (1998), Large et al. (1981), Douglas, Bash & Bozyan (1996)) were extracted from the NED archives. The JHK photometry points are from 2MASS IRSA catalog[1]. The EGRET data are taken from Thompson et al. (1995). The X-ray data are from *Chandra* X-ray Observatory (Bechtold et al. 2001, see discussion below) and from BeppoSax (Giommi et al. 2002).

Chandra ACIS-S observations of PKS 1127-145 (conducted on 2000-05-28) provide constraints on the jet model parameters. We analyzed the ACIS-S data in CIAO and found the best fit parameters for the assumed absorbed power law model fit to the Chandra X-ray

[1] http://irsa.ipac.caltech.edu/index.html

spectrum (0.3-7 keV; see analysis details in Bechtold et al. 2001, and Siemiginowska et al. 2002): photon index $\Gamma = 1.29 \pm 0.05$, absorbing equivalent Hydrogen column $N_H^{z_{abs}=0}$= $5.66 \pm 0.07 \times 10^{20}$ atoms cm $^{-2}$ (in excess to the Galactic column of 3.8 $\times 10^{20}$). This model gives a flux (2-10keV) = 5.35×10^{-12} ergs cm^{-2} s^{-1} which corresponds the X-ray luminosity of 4.9×10^{46} ergs s^{-1}. Such a value of Γ and the X-ray luminosity are consistent with the X-ray emission coming from the jet and a possible relation of this source to the MeV-blazars which we consider below. This is also strongly supported by a detection of PKS 1127-145 at hundreds keV with BeppoSax and at hundreds MeV with EGRET.

3. The model

Here we apply the *shock-in-jet* model scenario (e.g. Sikora et al. 2001) to the X-ray emission of PKS 1127-145. The emission processes contributing to the X-ray and gamma-ray band are related to the Inverse Compton scattering of the soft photons by the relativistic particles in the jet. In the Synchrotron Self-Compton (SSC) process the synchrotron photons emitted by the jet relativistic particles are Compton scattered by the same population of particles. In the External Radiation Compton (ERC) process the seed photons are located outside the jet.

We assume that due to collisions of two inhomogeneities propagating down the jet with different velocities, the shock is formed at a distance r_0 from the jet apex and terminated at $2r_0$. The shock propagates down the conical jet with bulk Lorentz factor Γ_b. In our model the high energy radiation is produced via the Compton process directly by accelerated electrons/positrons. The particles are assumed to stay in the acceleration zone for a much shorter period of time than the life-time of the shock and their acceleration/injection is approximated by a power-law function, $Q \propto \gamma^{-p}$, with the energy ranging from γ_{min} to γ_{max}.

In the External-Radiation-Compton scenario the X-rays are produced by the Compton scattering off the electrons in the slow cooling regime, and the gamma-rays by the Compton scattering off the electrons in the fast cooling regime (see Sikora et al. 2002 for details). The electron energy dividing both regimes is given by equality of the electron cooling time scale, $t'_c = \gamma/|\dot{\gamma}|$, to the shock life-time, $t' \simeq \Delta r_{coll}/(c\Gamma_b)$, where $|\dot{\gamma}| \simeq c\sigma_T u'_{ext}\gamma^2/(m_e c^2)$, u'_{ext} is the energy density of the external radiation field, and Δr_{coll} is the distance over which the collision of inhomogeneities takes place. The primed quantities are as measured in the shock comoving frame. Hence, the dividing energy is

$$\gamma_c = \frac{m_e c^2 \Gamma_b}{\sigma_T \Delta r_{coll} u'_{ext}} \,. \tag{1}$$

The dividing energy is imprinted in the Compton spectrum at the frequency:

$$\nu_c \simeq \frac{\mathcal{D}^2 {\gamma_c}^2 \nu_{ext}}{1+z}\,, \tag{2}$$

where ν_{ext} is the frequency of the external photons and $\mathcal{D} = 1/\Gamma_b(1-\beta cos\theta)$ is the Doppler factor of the radiating shocked plasma. The spectrum around ν_c changes its slope by $\Delta\alpha_{x\gamma} \simeq 0.5$.

The soft photons contributing the most to the external radiation field, u'_{ext} in the AGN cores could come from an accretion disk, from the Broad Emission Line Region (BEL) or from hot dust (IR) associated with an obscuring torus. Because of spectral similarities of PKS 1127-145 with the MeV-blazars we assume that the high energy radiation in this object is produced at a few parsecs, where u'_{ext} is strongly dominated by thermal radiation of the hot dust. PKS 1127-145 was not detected in the mid- and far-IR bands. However, the measured spectral turnover in the j, h, and k_s bands suggests a relatively strong contribution from the hot dust.

The presence of the hot dust in AGN is generally accepted as a part of the AGN paradigm (Urry & Padovani 1995). The minimal distance of the dust from the central engine is determined either by the maximal temperature it can survive,

$$r_{d,min} \sim \frac{1}{{T_{d,max}}^2} \times (L_{UV}/4\pi\sigma_{SB})^{1/2}\,, \tag{3}$$

where $T_{d,max} \simeq 1000 - 1500$K and L_{UV} is the disk luminosity, or by the inner edge of the molecular torus provided it is larger than $r_{d,min}$ given above (see, e.g., Yi, Field, & Blackman 1994). In our calculations we approximate the dust distribution as spherical and recover its minimum distance/maximum temperature from a model fit to the observed high energy spectrum. It should be emphasized here, that as long as the distance of the shock region from the black hole is smaller than the distance of dust, the value of $u'_{ext(dust)}$ is not very sensitive to dust geometry, e.g. whether the dust is distributed spherically or is located in the flattened torus. The density of the external IR radiation field can be approximated by the formula:

$$u_{ext(dust)} \sim \frac{\xi_{IR} L_{UV}}{4\pi c {r_{d,min}}^2} \times \frac{1}{1+(r/r_{d,min})^2}\,, \tag{4}$$

where ξ_{IR} is the fraction if the UV radiation converted by dust into thermal radiation.

We apply the model to PKS 1127-145 assuming that the parsec scale jet is pointing at or very close to the line of sight. This can be justified by detection of a superluminal motion in this source during the Multi-epoch VLBA observations with $\beta_{app} \sim 19$ (Jorstad et al. 2001). We compute the model by fitting the minimal distance/maximum temperature

of dust to the data. The results are presented in Figure 1, which shows the contributing model components: synchrotron emission, SSC, ERC(IR), ERC(BEL) and ERC(UV).

The ERC(BEL) is computed assuming that at $r > r_{BEL}$ luminosity of BEL drops with a distance $\propto 1/r$, where r_{BEL} is the distance at which the BEL luminosity peaks (e.g., Peterson 1993; Kaspi 2000). Parameters of the ERC model are given in the figure caption. They are obtained by matching: the Chandra X-ray spectrum, the EGRET flux, and the high frequency radio flux. The emission at lower frequencies (below $\sim 10^{10}$ Hz) is produced at significantly larger distances from the jet apex (in comparison to our model) and thus, is not taken into account in our modeling of the spectrum.

In Fig.1. we show also contribution into X-ray and γ-ray bands from Comptonization of direct accretion disk radiation (ERC(UV)). Using analytical approximations given by Dermer & Schlickeiser (2002), one can find that this contribution at a distance of a few parsecs is about four orders lower than the contribution from Comptonization of IR radiation of a hot dust.

Since observational data in different spectral bands are not simultaneous, the model spectral fit and its parameters should be considered only qualitatively. However, the Chandra and BeppoSax observations which were separated by 12 months, are both consistent with the extension of a very hard X-ray spectrum up to MeV energies and peaking at the level of the EGRET detection. Therefore the main result of our model — that X-ray emission of PKS 1127-145 is dominated by Compton scattering of the infrared photons — is not sensitive to the spectral changes between the observations.

4. Discussion

Our model shows that the X-ray and gamma-ray spectrum of PKS 1127-145 may originate in the parsec scale jet. This emission can be described entirely by the Comptonization of the IR radiation with a possible contribution from ERC(BEL) at energies > 1GeV. This object is similar to the other MeV-blazars where the SSC component is very weak and, therefore, the X-ray spectrum has a very hard slope down to the lowest energies.

Another interesting feature of PKS 1127-145 is the co-existence of a prominent UV thermal bump (as seen in radio-lobe dominated quasars), with the extremely luminous γ-ray component. Both components are very common for the MeV-blazars (see e.g. Tavecchio et al. 2000). In our model this co-existence can be associated with the distance between the shock and the jet apex which affects the synchrotron emission. The ratio u'_{ext}/u'_B is higher

for larger shock distances in MeV-blazars than for smaller shock distances in GeV-blazars, where in the former case the external radiation is dominated by infrared radiation of dust, while in the latter case it is dominated by broad emission lines, and $u'_B = B'^2/8\pi$ is the magnetic energy density in the shocked plasma in a jet. This results in a weaker synchrotron spectrum in MeV-blazars than in GeV-blazars assuming that both emit comparable bolometric luminosity. Secondly, the entire synchrotron component is shifted into lower frequencies in MeV-blazars (because the average frequency of the synchrotron radiation is $\nu_{SYN} \propto B^{'}$ and in our model magnetic field scales with distance like $B^{'} \propto 1/r$). Both effects diminish the synchrotron contribution to the UV-band, thus the thermal UV-bump becomes visible. Lower synchrotron luminosities in MeV-blazars explain also why in these objects the SSC component is weak ($L_{SSC} \propto {L_{SYN}}^2$) and, therefore, its contribution to the X-ray band is negligible (see Sikora et al. 2002).

The available EGRET data do not constrain the location of the luminosity peak and do not provide a spectral slope for the PKS 1127-145 γ-ray spectrum. Therefore, in order to minimize the number of free model parameters we adopted a single-power law electron injection function, instead a double-one assumed in modeling of other MeV-blazars (Sikora et al. 2002). This approach leads to a different location of the luminosity peak in our model spectrum of PKS 1127-145 ($h\nu \sim 100$MeV) than in the models of the other MeV-blazars (1MeV $< h\nu <$ 30MeV). Better γ-ray data are needed in order to apply the same model to both MeV-blazars and PKS 1127-145 and to constrain better the model parameters. However, based on the current observations of PKS 1127-145, we conclude that it is quite similar to other MeV-blazars. Since in the model, high energy radiation is produced at a few parsecs, we can predict that PKS 1127-145 should be variable in the X-ray and γ-ray bands on a time scale of the order of a month. Monitoring of the source with gamma-ray instruments such as Integral or GLAST may provide an opportunity to verify this prediction.

PKS 1127-145 has been included in samples of GigaHertz Peaked Spectrum (GPS) radio sources (Stanghellini et al. 1998). GPS sources are considered to be at an early stage of their expansion into large scale radio sources. However, GPS samples are heterogenous and may contain many blazars (Lister 2003; Siemiginowska et al. 2003; Stanghellini 2003). The X-ray data provide a way to identify blazars and separate them from the “true” GPS sources. It is important to understand a number of blazars in the GPS samples, so we can test whether they are consistent with blazars being “young” GPS sources, but seen along the jet, with the emission from the GPS double radio component suppressed by the parsec scale jet emission. This is critical to our understanding of the nature and evolution of radio sources.

Finally, it is worth noting the similarity of the PKS 1127-145 with other high-z X-ray luminous quasars with very hard X-ray spectra, e.g.: 1508+5714 (Moran & Helfand 1997); GB 1428+4217 (Fabian et al. 1998; Fabian et al. 2001); PKS 2149-306 (Elvis et al. 2000); PMN J0525-3343 (Fabian et al. 2000). All of them are FSRQ and with their peculiar spectra, similar to those of MeV-blazars, they can represent those FSRQ which have nuclei embedded in a very dusty environment. Such hypothesis can be further explored by detailed infrared spectroscopy of those sources and by observations of γ-ray spectra with GLAST which are expected to be relatively soft.

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REFERENCES

Bechtold, J., Siemiginowska, A., Aldcroft, T., Elvis, M., & Dobrzycki, A., 2001, ApJ, 562, 133

Błażejowski, M., Sikora, M., Moderski, R., & Madejski, G. 2000, ApJ, 545, 107,

Bozyan, E., Hemenway, P., & Argue, A. 1990, AJ, 99, 1421

Condon, J. J., Cotton, W. D., Greisen, E. W., & Yin, Q. F. 1998, AJ, 115, 169

Davis, J. E. 2003, SPIE 4851, 101

Dermer, C.D., & Schlickeiser, R. 1993, ApJ, 416, 458

Dermer, C.D., & Schlickeiser, R. 2002, ApJ, 575, 667

Douglas, J. N., Bash, F. N., & Bozyan, F. A. 1996, AJ, 111, 1945

Elvis, M., Fiore, F., Siemiginowska, A., Bechtold, J., Mathur, S., & McDowell J. 2000, ApJ, 543, 545

Fabian, A.C., Celotti, A., Iwasawa, K., & Ghisellini, G. 2001a, MNRAS, 324, 628

Fabian, A.C., Celotti, A., Iwasawa, K., McMahon, R. G., Carilli, C. L., Brandt, W. N., Ghisellini, G. & Hook, I. M. 2001b, MNRAS, 323, 373

Fabian, A.C., Iwasawa, K., Celotti, A., Brandt, W.N., McMahon, R.G., & Hook, I.M. 1998, MNRAS, 295, L25

Fossati, G., Maraschi, L., Celotti, A., Comastri, A., & Ghisellini, G. 1998, MNRAS, 299, 433

Geldzahler, B. J., & Witzel, A. 1981, AJ, 86, 1306

Griffith, M. R., Wright, A. E., Burke, B. F., & Ekers, R.D. 1994, ApJS, 90, 179

Giommi, P., Capalbi, M., Fiocchi, M., Memola, E., Perri, M., Piranomonte, S., Rebecchi, S. & Massaro, E. - Blazar Astrophysics with BeppoSAX and Other Observatories, Proceedings of the international workshop, December 10-11, 2001, ASI Science Data Center, ESA-ESRIN, Frascati, Italy. Edited by Paolo Giommi, Enrico Massaro, Giorgio Palumbo. ESA-ESRIN, 2002. p. 63.

Impey, C. D., & Tapia, S. 1990, ApJ, 354, 124,

Jorstad, S., Marscher, A., Mattox, J., Wehrle, A., Bloom, S., & Yurchenko, A. 2001, ApJS, 134, 181,

Kaspi, S. 2000, in ASP Conf. Proc. 224, Probing the Physics of Active Galactic Nuclei, eds. B.M. Peterson, R.W. Pogge, & R.S. Polidan (San Francisco: Astronomical Society of the Pacific), 347

Kellerman, K. I., & Owen, F. N. 1988, in Galactic and Extragalactic Radio Astronomy, ed. Verschuur & Kellerman (New York; Springer),563

Kuhr, H., Witzel, A., Pauliny-Toth, I. I. K., & Nauber, U. 1981, A&AS, 45, 367

Large, M. I., Mills, B. Y., Little, A. G., Crawford, D. F., & Sutton, J. M. 1981, MNRAS, 194, 693

Laor, A., Fiore, F., Elvis, M., Wilkes, B.J., & McDowell, J.C. 1997, ApJ, 477,93

Lister, M. L. 2003, to appear in "Radio Astronomy at the Fringe"; a conference held in Green Bank, WV in honor of Ken Kellermann's 65th birthday, eds. J.A. Zensus, M.H. Cohen, & E. Ros, ASP Conference Series (2003), astro-ph/0301332

Moran, E. C. & Helfand, D. J. 1997, ApJ, 484, L95

Morrison, R. & McCammon, D. 1983 ApJ, 270, 119

O'Dea, C. P. 1998, PASP, 110, 493

Peterson, B.M. 1993, PASP, 105, 247

Pica, A. J., Smith, E. P., Bohlin, R. C., O'Connell, R. W., Roberts, M. S., Smith, A. M., Fanelli, M. N., & Stecher, T. P. 1988, AJ, 96, 1215

Reeves, J.N., & Turner, M.J.L. 2000, MNRAS, 316, 234

Sanders, D.B., Phinney, E.S., Neugebauer, G., Soifer, B.T., & Matthews, K. 1989, ApJ, 347, 29

Shimmins, A. J., & Wall, J. V. 1973, AuJPh, 26, 93

Siemiginowska, A., et al. 2003, PASA, 20, 113

Siemiginowska, A., Bechtold, J., Aldcroft, T., Elvis, M., Harris, D. E., & Dobrzycki, A. 2002, ApJ, 570, 543

Sikora, M., Begelman, M. C., & Rees, M. J. 1994, ApJ, 421, 153

Sikora, M., Błażejowski, M., Begelman, M. C, & Moderski, R. 2001, ApJ, 554, 1

Sikora, M., Błażejowski, M., Moderski, R., & Madejski, G. M. 2002, ApJ, 577, 78

van Speybroeck, L. P., Jeriu, D., Edgar, R. J., Gaetz, T. J., Zhao, P., & Reid, P. B. 1997, Proc. SPIE, 3113, 89

Stanghellini, C. 2003, PASA, 20, 118

Stanghellini, C., O'Dea, C. P., Dallacasa, D., Baum, S. A., Fanti, R., & Fanti, C. 1998, A&AS, 131, 303

Steppe, H., Jeyakumar, S., Saikia, D. J., & Salter, C. J. 1995 A&AS, 113, 409

Tavecchio, F., Maraschi, L., Ghisellini, G., Celotti, A., Chiappetti, L., Comastri, A., Fossati, G., Grandi, P., Pian, E., Tagliaferri, G., and 4 coauthors, 2000, ApJ, 543, 535

Thompson, D. J., Bertsch, D. L., Dingus, B. L., Esposito, J. A., Etienne, A., Fichtel, C. E., Friedlander, D. P., Hartman, R. C., Hunter, S. D., Kendig, D. J. and 18 coauthors. 1995, ApJS, 101, 259

Urry, M. & Padovani, P. 1995, PASP, 107, 803

Wehrle, A. E., Cohen, M. H., Unwin, S. C., Aller, H. D., Aller, M. F., & Nicolson, G. 1992, ApJ, 391, 589

Wilms, J., Allen, A. & McCray, R. 2000 ApJ, 542, 914

Wright, A., & Otrupcek, R. PARKES CATALOGUE, 1990, AUSTRALIA TELESCOPE NATIONAL FACILITY

Yi, I., Field, G. B., & Blackman, E. G. 1994, ApJ, 432, L31

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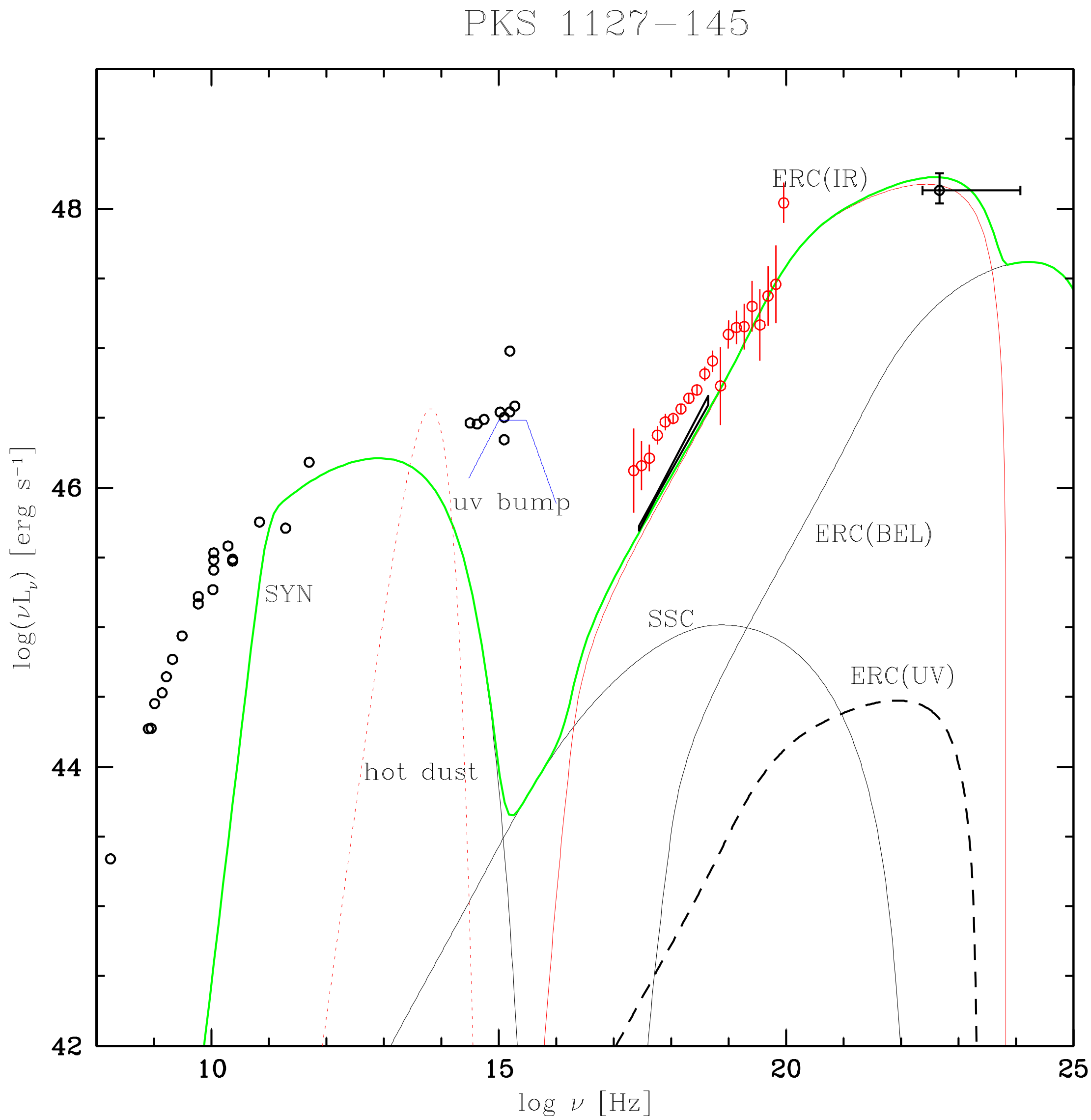
FIGURE CAPTIONS

Fig. 1.— The broad-band spectrum of PKS 1127-145 and the applied model components: SYN - synchrotron radiation, SSC - Comptonization of synchrotron radiation, ERC(IR) - Comptonization of the dust radiation, ERC(BEL) - Comptonization of the BEL radiation, ERC(UV) - Comptonization of the radiation from the accretion disk (assuming $M_{BH} = 10^9 M_\odot$), hot dust - mono-temperature thermal dust radiation, uv bump - UV radiation from the disk. The observational data are obtained from archival data, NED, Chandra (bow-tie in the energy range $0.66 - 22$ KeV), and BeppoSAX. The model parameters are as follows: $r_0 = 6.25 \times 10^{18}$cm; $\gamma_{min} = 1.0$; $\gamma_{max} = 6.0 \times 10^3$; the bulk Lorentz factor $\Gamma = 10$; the half-opening angle of the jet: $\theta_j = 1/10$; the observer is located at an angle: $\theta_{obs} = 1/10$; the magnetic field scales with the distance like $B^{'}(r) = (8.0 \times 10^{17})/r$ Gauss; the luminosity of the disk $L_{UV} = 1.0 \times 10^{47} erg/s$; maximal temperature of the dust $T_{d,max} = 800$ K; covering factor of the dust $\xi_{IR} = 0.5$ (part of the central UV radiation converted by dust into thermal IR radiation); covering factor of the BEL clouds $\xi_{BEL} = 0.08$ (part of the central UV radiation converted by BLR clouds into BEL radiation), minimal distance of the dust $r_{d,min} = 1.84 \times 10^{19}$ cm, $p = 1.55$. The following cosmology has been used: $\Omega_\Lambda = 0.7$, $\Omega_m = 0.3$, $H = 66$ km s^{-1} Mpc^{-1}.


PKS 1127−145
ERC(IR)
uv bump
ERC(BEL)
SYN
SSC
ERC(UV)
hot dust
log(νL$_\nu$) [erg s^{-1}]
log ν [Hz]
42
44
46
48
10
15
20
25